Accelerating Heat Dissipation in Hypersonic Aircraft and Missile Integuments Using Induced Supercriticality of Fluid Within Fluidic-Atmospheric Heat Exchangers

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Introduction

Hypersonic aircraft and missiles are limited in their loiter time by the tendency of integuments to melt at extreme temperatures. There are no materials which could possibly stand up to the sorts of temperatures; temperatures made inevitable by sustained friction with the atmosphere at hypersonic velocities. However, a sufficiently efficient cooling system or heating prevention system could enable standard heat-resistant materials to be able to survive sustained hypersonic flight. This author has even (ibid.) explored methods for forcing liquids to remain solid at extremely high temperatures, although that method has not been demonstrated outside of a laboratory setting.

Through an improved understanding of supercritical fluids as described in 15 June 2025, it should be possible to not only control the direction of travel of acoustic energy through an integument (ibid. 8 September 2023) in order to mitigate heating, but to enhance the transport of heat already created.

Abstract

If an aircraft or missile's integument is composed of alternating layers of metals and hollow pockets partially filled with water and those metallic layers include incorporated proton trap structures as described in 25 October 2025, the enhanced charge of electrons in the "steam" layers would decrease the transition temperature enabling supercriticality of the fluids, which would serve to achieve two goals:

1.) Alignments of water molecules in supercritical fluid channels would act as an insulator which prevents heat from moving into interior layers. Thus, if any one layer failed, the integument would yet have many thin layers remaining.

2.) Secondly, but most importantly, the supercritical fluids would rapidly transport heat from the nose of the aircraft or missile toward a heat exchanger at the rear. This transfer of heat, provided an artificially reduced supercriticality transition point, would actually have the effect of making the heat exchanger hotter than the nose of the missile or aircraft.

Conclusion

Enhancing the electrical charge of constituent electrons in a material layer may also have additional beneficial effects such as an increased tendency toward the generation of IR radiation in response, which would further enhance cooling.

The ability to build integuments capable of surviving sustained hypersonic flight combined with the ability to photo-magnetically propel the missiles (the heat exchanger could be composed of the thermoelectric material described in 8 June 2025 and could provide sufficient energy to generate the intense light needed for further propulsion as well as provide a "cold terminal" to support the heat-exchange function.) would make hypersonic missiles with few limits on loiter time technically feasible. Primary power for a photo-magnetic propulsion system could be derived from an endo-molecular fusion power plant (ibid. intra-molecular fusion) with the heat exchanger making it possible to recycle much but not all of the energy used. Fascinatingly, the fusion power plant would likely only generate enough energy to get the system up to about Mach 1.8, but at those velocities, the heat generated in the integument would act like a sort of capacitor which could store energy temporarily and, given the thermoelectric energy recycling system, the craft would experience a speed boost after the integument "warms up."